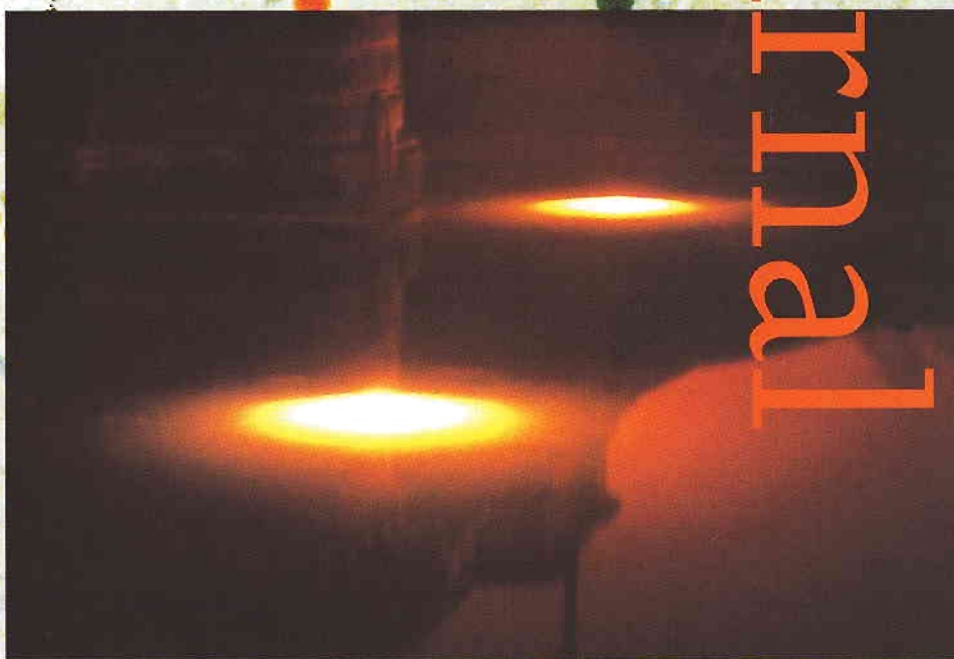


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Cover: Pulsa, untitled (sound-light installation, pond, Boston Public Garden), 1968, diagram and inset installation view, Boston, Massachusetts, October 1968 (artwork and photographs © Pulsa). See p. 54.

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Forty years ago this fall the Institute for Contemporary Art in London hosted a groundbreaking exhibition of computer-aided creative works. Three years in the planning, *Cybernetic Serendipity* marked a high point both in early conjunctions between technology and the arts and in the early configurations by its young curator, Jasia Reichardt, of what would come to be called new media. *Cybernetic Serendipity* opened less than three months after the upheavals of May 1968 and as

the conflict in Vietnam, to which the language of command, control, and communication had been so integral, was covertly escalating under the flag of “peace with honor.” The fate of Reichardt’s ambitious presentation of creative and sophisticated technical collaboration is instructive on many levels: the show itself was received alternately as mass entertainment or as failed high art, while many of the works themselves proved too fragile to survive transportation to

other venues. Serendipitously or not, the show’s advent was simultaneous with the rise of poststructuralism, which brought to the fore a strong critique from the artistic and theoretical realm of precisely the kind of servo-dynamic information model that governed first-order cybernetic thinking. As a result, both the exhibition and its long-active and inquiring curator have been relatively scanted by art history. Despite the development of a nuanced, dialogical, second-order discourse within cybernetics, one with an emphasis on self-organizing and spurred by the work of thinkers like Gregory Bateson, Francisco Varela, Humberto Maturana, Gordon Pask, and others, in the 1960s cybernetics as a whole was tarred with military associations and met with a similar reception; it has only recently resurfaced on the radars of art scholars and practitioners as an area of productive inquiry. This new-found interest in systems thinking has in turn been retooled by more complex ecological models in which—at risk of radically simplifying—signal is deconstructed by noise.

In this issue we revisit several cybernetically inflected projects of the late 1960s and early 1970s. María Fernández presents a tight case study of *Cybernetic Serendipity*, examining the show’s reception as well as the broader intellectual formation of its curator. In a careful unraveling of linguistic nuance, Midori Yoshimoto looks at one of the key moments in the linking of technology and intermedia in Japan, *From Space to Environment*, held in Tokyo at the Matsuya Department Store Gallery and at the Sōgetsu Art Center in 1966. Yates McKee recovers the sound-and-light work of the early 1970s American group Pulsa, while taking critical measure of the technoscientific optimism it emerged from, deployed, and to some extent exemplified. William Kaizen represents early video projects of Dan Graham in the context of the second-order cybernetic framework provided by Bateson, in dialogue with the art historian Meyer Schapiro, among others. The artist and theorist Jordan Crandall updates these historical examples with a project exploring the limits of subjectivity and feedback. And the film theorist Jonathan Thomas, whose essay on filmmaker Michael Haneke’s *Caché* meticulously parses the use of media imagery and its articulation of traumatic memory, reminds us once again of the noise of history and of the power of its embodiment.

Judith F. Rodenbeck

In This Issue: Not Your Daddy’s Servo



Pulsa, untitled (Yale Golf Course light-sound installation), 1969, strobe lights, polyplanar speakers, computer, analogue-digital synthesizer control system, and punched-paper tape reader; installation view, Yale Golf Course, New Haven, Connecticut, November 1969 (artwork and photograph © Pulsa; photograph by William Crosby, provided by Michael Peter Cain)

By rendering the invisible visible through systems-consciousness, we are beginning to accept responsibility for the well-being and continued existence of life upon Earth.

—Jack Burnham

The real issue is not the survival of the human species but the survival of political power.

—Jean Baudrillard

In his 1969 Artforum essay “Real-Time Systems,” a programmatic application of cybernetic principles to a panoply of “post-formalist” artists including Hans Haacke, Robert Barry, and Les Levine, Jack Burnham devotes several paragraphs

to Pulsa, an interdisciplinary group of “planners and coordinators functioning in the industrial, urban, and natural environments,” whose “computer-based programs of light and sound” exemplified the expansive possibilities of a systems-oriented aesthetic production. Referring to a nocturnal project in which Pulsa retrofitted the picturesque landscape of the Yale golf course with a network of fifty mutually responsive strobe lights and loudspeakers, Burnham’s account concludes with a highly elliptical anecdote:

The full impact of taking art out of its acceptable surroundings did not reach me until last winter. I flew in a plane over the Pulsa installation on the outskirts of New Haven, circling

into their light configuration for about ten minutes before heading east for Boston. Five minutes away, I heard a radio conversation between a small plane and air control at New Haven. The plane reported a “disturbing” light phenomenon on the ground. Air control told the pilot to file a complaint with the C.A.A. [Civil Aeronautics Administration].¹

What are the implications of this momentary disturbance of the air-control system? Was anything communicated by these luminous signals, or did they merely constitute a kind of entropic noise to be filed away by the C.A.A.? Might such noise carry its own communicative possibilities?

While throughout “Real-Time Systems” Burnham seems to valorize art as a force of optimal performance, systemic stabilization, and ecological adjustment, the conclusion to the essay speaks obliquely to the stakes of Pulsa’s “disturbance.” Invoking a residually avant-gardist model of the artist, Burnham writes, “To use another cybernetic analogy, artists are ‘deviation amplifying’ systems, or individuals who . . . are compelled to reveal psychic truths at the expense of existing societal homeostasis. With increasing aggressiveness, one of the artist’s functions is to specify how technology uses us.”² On the one hand Burnham seems to intimate that revealing the “psychic truth” of how we are used by technology would involve, in traditional humanist fashion, an inversion of this apparently aberrant relationship, restoring the proper status of humanity as user and master of the technology it has created. Yet such an appeal to the possibility of a self-conscious, properly human agency vis-à-vis technology is complicated at an earlier point in the essay when Burnham invokes Marshall McLuhan’s account of the “metabolic reorganization” of planetary ecology in which automated decision-making and data-processing systems play a constitutive role.

The Public Sensoriums of Pulsa: Cybernetic Abstraction and the Biopolitics of Urban Survival

Yates McKee

The epigraphs are from Jack Burnham, *Beyond Modern Sculpture: The Effects of Technology and Science on the Sculpture of This Century* (New York: Braziller, 1968), 292; and Jean Baudrillard, “Statement by the French Group: The Environmental Witch-Hunt,” in *The Aspen Papers*, ed. Reyner Banham (New York: Praeger, 1974), 208, cited in Felicity Scott, *Architecture or Techno-Utopia: Politics after Modernism* (Cambridge, MA: MIT Press, 2007), 235.

In elaborating this paper, thanks are due to Branden W. Joseph, my anonymous *Art Journal* reader, my primary interlocutor Jaleh Mansoor, and most especially the founding members of Pulsa for their remarkable artworks and generosity with archival images and historical testimony: Michael Peter Cain, Patrick Clancy, and David Rumsey.

1. Jack Burnham, *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century* (New York: Braziller, 1968), 36.

2. Jack Burnham, “Real-Time Systems,” in *Great Western Salt Works: Essays on the Meaning of Post-Formalist Art* (New York: Braziller, 1974), 38–39.

Against an archaic model of culture in which humanistic knowledge is concerned with the exploration of “comparative values,” Burnham affirms that “where advanced technology takes over, our values are chosen for us—if survival remains high on our list of priorities.” Burnham calls for the acknowledgement that “the Earth and its guests (as Buckminster Fuller would have it) [are] a total organism with its own metabolism,” the stability of which is crucially dependent on “extensive communication networks, including memory, feedback, and automatic decision-making capacities . . . [and] the many operating real-time systems which gather and process data from environments, in time to effect future events within those environments.”³ Survival, then, is impossible without attending to the constitution of humanity within systems that in some way automate and calculate the temporality of life, aiming to preemptively correct “disturbances” at the very moments they occur. Thus, if art is to “specify how technology uses us,” this will involve not a simple control by humanity of technology in any traditional sense, but rather a humanity for whom automated technical systems of communication, storage, and control are conditions of life itself—a notion of “survival” later theorized in Bernard Stiegler’s *Technics and Time* as “the pursuit of life by means other than life.”⁴ Anticipating the charge of technocracy that would later be launched against his work, Burnham remarks that “humanists share an instinctive antipathy for these immensely complex computer systems,” but asserts that “it is imperative that artists do understand them—both philosophically and technically.”⁵

This essay explores the aesthetic and political stakes of Burnham’s oscillation between an imperative of homeostatic equilibrium on the one hand and “deviance amplification” on the other through an extended consideration of Pulsa. This hitherto underappreciated collective was founded in 1967 by a group of painters, musicians, sculptors, and engineers working at Yale University.⁶ While the group was invested in a project of nonreferential, anti-expressive abstraction and sensitizing its audience vis-à-vis the spatio-temporal conditions of perception in a semi-minimalist vein, a key catalyzing event for its formation was participation in one of Buckminster Fuller’s famous World Game sessions, in which players would collaborate in modeling solutions for the optimal distribution of planetary energy resources with the aim of “making the world work” in such a way as to transcend geopolitical conflict.⁷ Pulsa thus emerged at the crux of several important strains of experimental art practice in the late 1960s—strains that have until recently been understood as separate if not outright antithetical. The first strain is that catalogued in Jim Burns’s 1972 book *Arthropods: New Design Futures*, which, like Gene Youngblood’s 1970 *Expanded Cinema*, conceived the artist as an intermedia “ecologist” facilitating the design of open systems, structures, and spaces amenable to collective participation and transformation over and against the “closed system” strictures of modernist medium-specificity in art and architecture alike.⁸ Like Burnham’s thought, this countercultural strand was heavily informed by McLuhan, Fuller, and John McHale, situating the ecological activity of the artist within expanded planetary networks of energy and information imagined to be approaching a state of perilous disequilibrium in which “species survival” itself was at stake.⁹ The concern of figures such as Burns and Youngblood with media, energy, and survival overlapped in important ways with a second, rather more sober discourse with which Pulsa was also in dialogue.

3. Ibid., 27.

4. Bernard Stiegler, *Technics and Time: The Fault of Epimetheus*, trans. Richard Beardsworth and George Collin (Stanford: Stanford University Press, 1998), 135.

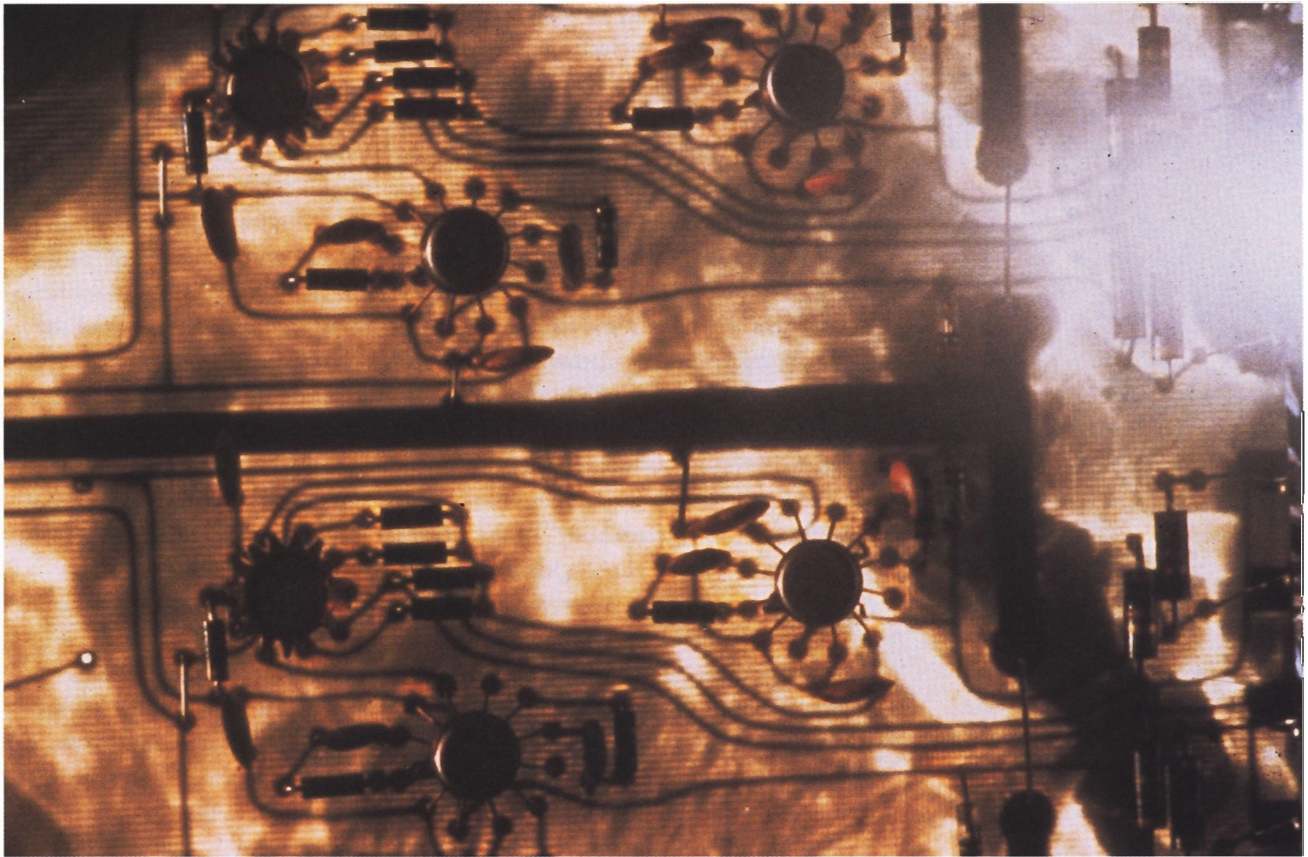
5. Burnham, “Real-Time Systems,” 25.

6. E-mail exchange with Patrick Clancy, April 2007. The founding members of Pulsa were Michael Peter Cain, Patrick Clancy, and David Rumsey. They were joined in 1967 by William Crosby, Bill Duesing, Paul Fuge, and Peter Kindlmann, along with a wide array of temporary collaborators, especially from the domain of experimental music. For a detailed account of the group’s trajectory, see Woody Valsuka’s 1992 interview with Clancy, available online at www.vasulka.org/archive/Interviews/53Clancy.pdf. For the rediscovery of cybernetic discourses in art history, see Reinhold Martin, *The Organizational Complex: Architecture, Media, and Corporate Space* (Cambridge, MA: MIT Press, 2003); Pamela Lee, *Chronophobia: Time in the Art of the Sixties* (Cambridge, MA: MIT Press, 2004); and David Joselit, *Feedback: Television against Democracy* (Cambridge, MA: MIT Press, 2007). Most polemically and programmatically, see Luke Skrebowski, “All Systems Go: Recovering Hans Haacke’s Systems Aesthetics,” *Grey Room* 30 (Winter 2008): 55–79.

7. On Fuller’s World Game—and its attendant claim to replace the violence of geopolitical weaponry with the postpolitical harmony of “livingry”—see Mark Wigley, “Planetary Homeboy,” *Any* 17 (1997): 16–23. On the contested currency of the World Game among countercultural producers in the late 1960s and early 1970s, see Felicity Scott, *Architecture or Techno-Utopia: Politics After Modernism* (Cambridge, MA: MIT Press, 2007), 202–4.

8. See Jim Burns, *Arthropods: New Design Futures* (New York: Praeger, 1972); and Gene Youngblood, *Expanded Cinema* (New York: Dutton, 1970).

9. For a discussion of these three figures, see Mark Wigley, “Recycling Recycling,” in *Eco-Tec: Architecture of the In-Between*, ed. Amerigo Marras (Princeton University Press: 1999), and Wigley, “Network Fever,” *Grey Room* 4 (Summer 2001): 83–122.



Pulsa, Pulsa Circuit (voltage-controlled multiple-waveform generator), 1968–72, component of analogue-digital signal synthesizer control system (artwork and photograph © Pulsa; photograph provided by Michael Peter Cain)

This was the post-Bauhaus environmental design agenda of the Center for Advanced Visual Studies at the Massachusetts Institute of Technology, the mandate of which was programmatically formulated by its founder György Kepes in his classic statement “Art and the Ecological Conscience,” first delivered at the Museum of Modern Art (MoMA) in New York in 1972 and subsequently reprinted as the introduction to the volume *Arts of the Environment*, to which Pulsa was a contributor: “Environmental homeostasis on a global scale is now necessary to survival. Creative imagination, artistic sensibility, can [serve] as one of our basic, collective, self-regulating devices that can help us register and reject what is toxic in our lives.”¹⁰ Finally, Pulsa engaged the formal and perceptual questions raised by Postminimalism and certain strands of conceptualism regarding light, time, space, and sound as expanded, non-object-centered materials for the sensitization and activation of what was considered an otherwise anesthetized and atomized everyday experience. (The related but paradigmatically distinct light-sculptures and landscape interventions of Anthony McCall, for instance, provide a resonant contemporary comparison). Complicating a purely “materialist” or phenomenological model of the perceiving subject with an interest in the technically mediated “psycho-physiological” networks of the human sensory system, Pulsa hybridized these tendencies, refracting them through a cybernetically informed understanding of complex urban agglomerations, perceived to be on the verge of unsurvivable crisis due to a pervasive ecological maladjustment among subjective perception, energy systems, and physical organization.

10. György Kepes, “Art and the Ecological Conscience,” *Arts of the Environment* (New York: Braziller, 1972), 72. On Kepes’s conjugation of Bauhaus design discourse and cybernetic models in the figure of the informational “pattern” see Martin, 51–79.

Imagining the city as what Mark Wigley has called an “artificial body . . . globalized into a vast electronic network mirroring the internal electricity of the human nervous system . . . in which the distinction between nature and culture cannot be easily made,” Pulsa aimed to construct what it called “new public sensoriums” for the city.¹¹ Playing on the neurophysiological term for “the part of the brain that receives and coordinates all the stimuli conveyed to various sensory centers,” the aesthetic-philosophical sense of the “entire sensory system of the body,” and other Latinate sociospatial figures such as “symposium” and “sanitarium,” Pulsa’s public sensoriums were designed to facilitate an “abstract aesthetic awareness” of the city and its life-supporting infrastructures on the part of the human organisms populating it.¹² Thus, Pulsa’s eco-aesthetic imperative of urban survival was engaged with biopower in the precise Foucaultian sense of “a new mode of relation between history and life . . . that placed it at the same time outside of history in its biological environment and inside human historicity, penetrated by the latter’s techniques of knowledge and power.”¹³ With what Foucault would call the “species body” of the city understood as an assemblage of biological processes and technological systems, Pulsa hoped the “aesthetic abstract awareness” fostered by its works might eventually be fed back into a set of solutions for an otherwise fragmented and entropic organization of life.

As with its interlocutor Burnham, the key question that haunts Pulsa is to what extent its project might have acted as a “deviance-amplifying mechanism” with regard to the homeostasis of actually existing biopolitical arrangements, or conversely, to what extent it might have contributed to the stabilization of the latter along the lines of what Jean Baudrillard denounced, in his 1972 text “Design and Environment,” as “an aesthetic operationalism . . . that is indistinguishable from cybernetic programs.”¹⁴ First announced at the same MoMA symposium as Kepes’s “Art and the Ecological Conscience,” Baudrillard’s charge of “aesthetic operationalism”—the mobilization of experimental artistic techniques in the aim of facilitating the functional and harmonious working of systems over time rather than of challenging their underlying logic—is in some respects quite germane to the work of Pulsa, especially when compared to the revolutionary claims of research-design groups such as the Situationists or Utopie (of which Baudrillard was a primary theoretical spokesperson).¹⁵ However, Pulsa’s project complicates any simple opposition between an art of technocratic planning on the one hand and of antisystemic radicality on the other, requiring us to consider the possibilities, challenges, and blind spots of cybernetic models even while these remained unexamined in the work of Pulsa itself. As I suggest below, the work of Pulsa opens onto several highly fraught problematics in contemporary art, including participatory feedback, urban research, and the articulation of technological systems, phenomenological experience, and ecological awareness.

Published in Kepes’s *Arts of the Environment* anthology, Pulsa’s self-expository statement, “The City as Artwork,” begins by describing the city as an “artifact system” made up of “hard architectural systems” on the one hand and “soft information systems” on the other, a distinction becoming increasingly undecidable: “The information systems are becoming more architectural while the architecture is becoming less object-like and more systemic. The city is now a flexible mutating object.”¹⁶ But despite the *de facto* undoing of distinctions

11. Wigley, “Recycling Recycling,” 41.

12. See Susan Buck-Morss’s related discussion of what she interprets as Walter Benjamin’s call to “undo the alienation of the corporeal sensorium . . . not by avoiding the new technologies, but by passing through them,” in “Aesthetics and Anaesthetics: Walter Benjamin’s Artwork Essay Reconsidered” (1992), in *October: The Second Decade, 1986–1996*, ed. Rosalind Krauss et al. (Cambridge, MA: MIT Press, 1996), 377. See also *Sensorium: Embodied Experience, Technology, and Contemporary Art*, ed. Caroline A. Jones (Cambridge, MA: MIT Press, 2006).

13. Michel Foucault, *The History of Sexuality*, vol. 1, trans. Robert Hurley (New York: Vintage, 1978), 142–43. For an extension of Foucaultian analysis to the “bio-economic” global systems of ecology, see Paul Rutherford, “The Entry of Life into History,” in *Discourses of the Environment*, ed. Eric Darier (London: Blackwell, 1999), 37–62.

14. Jean Baudrillard, “Design and Environment; or, The Inflationary Curve of Political Economy,” in *The Universitas Project: Solutions for a Post-Technological Society*, ed. Emilio Ambasz (1972; New York: Museum of Modern Art, 2006).

15. See Jean Baudrillard, *Utopia Deferred: Writings from Utopie, 1967–1978*, trans. Stuart Kendall (New York: Semiotext(e), 2006). On Baudrillard’s early critical interventions in discourses of design and environment in the United States see Scott, 111–14.

16. Pulsa, “The City as an Artwork,” in *Arts of the Environment*, 208. Further quotations from this article are cited parenthetically in the text.

between the static built environment and the dynamism of immaterial communication networks that constitute urban life, dominant approaches to urban design, Pulsa claims, continue to propagate a fetishistic image of the city that disavows the technologization of the environment. This has the deleterious effect of rendering the systems in question perceptually and cognitively inaccessible, and thus insulated from transformation, improvement, or participation by those who depend on them for survival: "Much of the design in this country is based on an aesthetic of concealment and a concern for picturesque facades, the unstated goal of which is an environment superficially resembling a pre-technological society. This nostalgia leads not only to malfunction but to a basic alienation from the systems that make life in a given environment possible" (210).

According to Pulsa, urban inhabitants are in fact connected, interdependent, and networked; yet the structures, spaces, and technologies they use on a daily basis are organized in such a way as to promote a sense of alienation, specialization, and individualization, "a set of fixed and isolated structures—insulated offices, insulated private residences, insulated manufacturing centers . . . which offer little possibility for interaction among inhabitants" (211). For Pulsa, a major part of the problem is that dynamic life-support systems—heat, water, electricity, communication, transportation—are seamlessly integrated into the conventional phenomenal fabric of the city and thus naturalized to the point that they cease to be a matter of concern, investment, and potential transformation by urban inhabitants.

In order to counteract the fixing and isolation of the city, Pulsa calls for "unrestricted public experiments to redefine the urban environment in terms that clarify and support the reality of man's existence within the city" (210). This task would revolve around those media understood to be closest to immaterial "pulses" of energy such as light, sound, heat, and the neurological waves circulating through the "parallel-processing system" of the human brain. Pulsa analogizes these pulsations of energy to the data-processing systems of telecommunications networks, but with any sense of a detachable message rigorously suspended, insisting on a heightened sensory interaction between subjects and ambient conditions without the interference of the overt psychedelic or counter-cultural iconography mobilized (with different ideological inflections) by *Arthropods* colleagues such as Ant Farm or USCO.

Indeed, in its own contribution to *Arthropods*, Pulsa sounds a polemically modernist note, insisting that its work is "nonassociational, nonreferential . . . a metaphor of itself, a metaphor of electronic energies. It is a total abstraction, a network of energy existing in its own time and space."¹⁷ However, this appeal to total abstraction was neither a matter of withdrawing into a realm of transcendental autonomy outside the social world nor of projecting a utopian future beyond the given conditions of the present. Rather, Pulsa's approach to abstraction involved what Briony Fer would call a "fantasy" of retraining the individual and collective sensorium in such a way as to make legible the transformations to which the human organism was exposed by new technologies and environments.¹⁸ Contributing to a panel in 1969 on time as an artistic material, a Pulsa representative similarly invokes abstraction as a key aesthetic strategy and philosophical stance. Beginning with the assertion that "time has no absolute rate of succession," and that "a given culture sets up its own framework in which people

17. Pulsa, quoted in Burns, 139.

18. In *Abstract Art* (New Haven: Yale University Press, 1997), Fer attempts to "re-imagine the kinds of fantasies that may be involved in art that does not picture things in the world but which nonetheless claims its objecthood as a painting or sculpture," 4. Especially resonant in light of Pulsa's concern with the figure of "survival" is Fer's citation of Carl Einstein's remark that the obsession with "purity" in modernist abstraction "derives from the anxiety before the invisible and before the sudden disappearance by death," 2.

can relate to time,” the Pulsa spokesperson suggests that emergent large-scale technical systems of communication and control have exposed the fragility of such contingent cultural constructions: “Our total environment is electric . . . our temporality is determined by electronic technology. In such an environment, it seems crucial to the Pulsa group that a public art form be developed to deal with these phenomena to create an abstract, meaningful force that deals specifically with people’s experience today in terms of time and space.”¹⁹

In a short consideration of the group from the same year, Lucy Lippard echoed this understanding of Pulsa’s abstraction, writing that “the configurations created [by Pulsa] were so abstract that they seemed to exist on the threshold of perception. . . . By discouraging imagery of any kind . . . the group demands a gradual perceptual adaptation in the participant. The sensitive response can be called psycho-physiological rather than just sensuous or physical.” In other words, Pulsa imagined the subjective sensorium less in terms of the self-reflexive corporeality of Maurice Merleau-Ponty, embraced by the Minimalists, than in terms of the “physiological optics” of Hermann von Helmholtz: the nineteenth-century scientist is a key reference for Kepes in his discussion of the “influence of artificial lighting . . . [on] the total environment of the human organism” in *The Language of Vision*, where Kepes further asserts that artists “can be important pioneers in testing the psycho-physiological effects of the plastic organization of light” and might “help retrain us to a better understanding of the shaping of our physical environment.” Recalling Kepes’s observation that “nature’s pattern of alternating night and day has become a continuous ribbon of day-and-night,” and the interest of Kepes’s teacher László Moholy-Nagy in “the cityscape at night as a pure pulsating light sculpture,” Pulsa devoted special attention to the exploration of urban lighting systems as a nocturnal index of the technical and ecological interdependence of the city.²⁰ Pulsa wrote, “At night the city’s lights make it function more on a level of pure information. The artificial aspect of the city is most apparent and meaningful at that time, but it should be pushed further” (210).

Though written before his encounter with Pulsa, Burnham’s positing of light as sculptural medium coincides closely with the program of Pulsa and is worth considering: “The controlled use of light is the most flexible visual art form devised [and] best demonstrates one of the main qualities of systems: the tendency to fuse the art object and the environment into a perceptual whole. The trend of Light Art is to eliminate the specific art object and to transform the environment into a light-modulating system sensitive to response from the organisms that invade its presence.” Defined as “the visual impression received when an area of light exceeds a threshold of brilliance relative to its surroundings,” Burnham ascribed a transhistorical meaning to “the quality of luminosity,” connecting it to a basic impulse of ecological survival on the part of the human species: “To the observer [of luminosity], the glowing quality appears to be the result of an internal energy in the source itself. Possibly this explains why luminosity acts as an emotional stimulant: primeval man’s response was to be drawn toward the life-giving energy sources of heat and light.” Echoing the recently formulated idea of dematerialization but linking it to a model of ecological systems that was relatively foreign to mainline conceptual art, Burnham goes on to associate contemporary interest in light as a medium with what he calls

19. Remarks by Michael Cain on behalf of Pulsa on March 17, 1969, at “Time: A Panel Discussion,” partially transcribed by Lucy Lippard in *Six Years: The Dematerialization of the Art Object from 1966 to 1972* (1973; University of California Press, 1997), 81–82. The panel was organized by Seth Siegelaub and also featured Carl Andre, Douglas Huebler, and Ian Wilson, a lineup that suggests the complexity of the Postminimalist crux at which Pulsa’s work emerged. In a short consideration of Pulsa that also speaks to this conjuncture.

20. Lucy Lippard, “Pulsa,” *Arts Canada*, December 1968, 59. György Kepes, *The Language of Vision* (1944; Mineola, New York: Dover, 1995), 155. This section of Kepes’s book echoes almost word for word the discussion of artificial light as a “new field of expression” in László Moholy-Nagy, *The New Vision: Fundamentals of Bauhaus Design, Painting, Sculpture, and Architecture* (1938; Mineola, NY: Dover, 2005), 142–45. See also Jonathan Crary’s discussion of Helmholtz and the “retraining” of the subjective sensorium vis-à-vis emergent technological assemblages in the nineteenth century in *Suspensions of Perception: Attention, Spectacle, and Modern Culture* (Cambridge, MA: MIT Press, 1999), 214–19. On the cultural fantasies and anxieties of the artificially illuminated urban nightscape, see Wolfgang Schivelbusch, *Disenchanted Night: The Industrialization of Light in the Nineteenth Century* (1983; Berkeley: University of California Press, 1995). Significantly, in light of the relations among urban illumination, capitalist circulation, and social discipline outlined by Schivelbusch, the proto-Situationist Lettrist group claimed, as one of its tactical psycho-geographic prescriptions for Paris, that “street lamps should all be equipped with switches so that people can adjust the lighting as they wish.” “Proposals for Rationally Improving the City of Paris” (1955), trans. Ken Knabb, available online at www.bopsecrets.org/SI/paris.htm.

21. Burnham, *Beyond Modern Sculpture*, 302 and 311.

22. Marshall McLuhan, *Understanding Media: The Extensions of Man* (New York: Signet, 1963), 24.

23. Lynch relates the “legibility of the cityscape”—“the ease with which its parts can be recognized and can be organized into a coherent pattern”—to a biological imperative of survival. “Structuring and identifying the environment is a vital ability among all mobile animals . . . there is a consistent use and organization of definite sensory cues from the external environment. This organization is fundamental to the efficiency and to the very survival of free-moving life.” Kevin Lynch, *The Image of the City* (Cambridge, MA: MIT Press, 1960), 2–3.

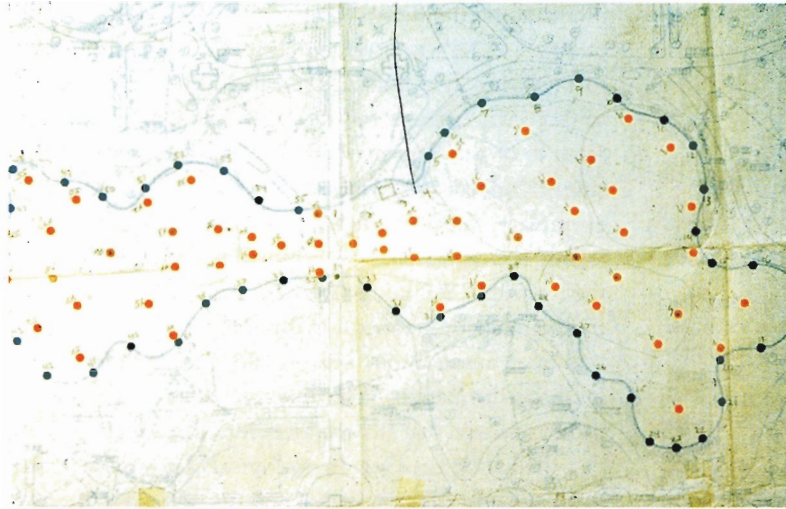
24. Lynch originated this term in his discussion of the “imageability” of large-scale urban organizations on the part of individual urban inhabitants moving through them on a day-to-day basis. Lynch, 9–13. The term was famously appropriated by Fredric Jameson in his Marxist analysis of how the individual subject might aesthetically imagine and critically recognize its relation to the otherwise overwhelming networks of transnational capitalism.

25. Michelle Kuo cites Klüver’s remark in her revisionist account of the infamous technical failures and breakdowns that marked Experiments in Art and Technology’s *9 Evenings of Theater and Engineering* (1966); Klüver was a founder of EAT. Kuo draws on Nikolas Luhman’s neo-systems theory to argue that the possibility of technical failure and breakdown in the realization of the artworks in fact raised productive questions pertaining to the relation between *chance* as a formal procedure of temporal indeterminacy and the social question of risk associated with the acceleration and globalization of technical systems. Kuo, “9 Evenings in Reverse” *9 Evenings Reconsidered: Art, Theater, Engineering, 1966*, ed. Catherine Morris (Cambridge, MA: MIT List Center, 2006), 31.

26. See Donella H. Meadows et al. *The Limits to Growth: A Report for the Club of Rome’s Project on the Predicament of Mankind* (New York: Universe, 1972). The visual centerpiece of the report was “The World Model,” a remarkable feedback diagram of the projected disequilibrium among population, resources, capital investment, and pollution designed by Jay Forrester. Elements of this diagram also appear in Forrester’s article “Planning under the Dynamic Influences of Complex Social Systems,” in *Arts of the Environment*, 152–56. See Wolfgang Sachs’s exemplary Marxist critique of the report’s positing of “survival as the new *raison d’être* for ecocratic managerialism” in “Environment,” in *The Development Dictionary: A Guide to Knowledge as Power*, ed. Wolfgang Sachs (London: Zed, 1992), 26–37.

“the cultural trend toward intangibility”: “Light . . . is the incarnation of visible energy. . . . The writer remembers when in a lecture Marshall McLuhan pointed to a glowing light bulb and remarked that it radiated pure information—at least to those who understood its signal. Increasingly pure energy and information seem to be the essence of art; all else is being dropped methodically by the way-side.”²¹ Indeed, in *Understanding Media*, McLuhan had cited the electric light as the exemplary “medium without a message,” a purifying counter to the fact that “it is only too typical that the ‘content’ of any medium blinds us to the character of the medium.” Yet unlike Greenbergian medium-specific abstraction, the radiant transparency of the medium for McLuhan involved not a self-reflexive investigation of an autonomous aesthetic domain, but rather a kind of map of sociotechnical transformation: “The ‘message’ of any medium . . . is the change of scale or pace or pattern that it introduces into human affairs.”²²

Mediating between an ecological concern for material survival on the one hand and a fascination with a radically dematerialized aesthetic practice on the other, Pulsa’s ambition was to aesthetically intervene in the urban environment in an avowedly abstract fashion so as to bring into visual relief its always-already “abstract” quality, which is to say its constitutive interrelation with networks of energy and information flow. Echoing Kevin Lynch’s concern with “the legibility of the cityscape,” such interventions would be motivated by a desire to instill in an urban public the capacity to “read” the luminous signals emitted by the built environment at night.²³ The point for Pulsa was not to decipher any specific semantic content, but rather to track “pure” indicators of the life-supporting organizational patterns of the city, generating what Lynch would call a “cognitive map” of an urban system on the verge of crisis.²⁴ For Pulsa, this crisis was symptomized by urban blackouts, when the everyday energy networks of the city were at once disrupted and thrown into relief, an echo of Billy Klüver’s remark that the “Great Northeastern Power Failure” of 1965 “could have been an artist’s idea—to make us aware of something.”²⁵ Echoing the rhetoric of biopolitical crisis put forward contemporaneously in the Club of Rome’s *Limits to Growth* report, Pulsa framed the figure of the urban blackout as a form of perceptual estrangement capable of imparting to urban subjects a sense that “the finiteness and perimeters of a city should be recognized as defined by the resources necessary for survival and the limitations of the systems which carry these energies into the city. Urban conglomerations are not capable of infinite expansion . . . [blackouts] elucidate the folly of the notion that electricity, automobiles, food and so on, come from inexhaustible sources” (213).²⁶ Against the allegedly hubristic assumption of unlimited urban growth, Pulsa posited its experiments with light and time as prefiguring the eventual construction of “public research centers” that would generate “widespread readouts of the city’s resources . . . [and] computer storage of facts and statistics about the evolution of the city so that its projected developments could be realized” (210). The fantasy-structure of Pulsa’s abstractionist program thus involved instigating a linear movement within the viewer from a heightened phenomenological perception of “pure information” pulsing through the networked urban environment, to an enhanced cognitive capacity to read the empirical environmental data pertaining to infrastructures and resources, to an eventual real-time agency in transforming the city in the direction of an ecologically sustainable and collectively oriented urbanism.



Pulsa, untitled (sound-light installation, pond, Boston Public Garden), 1968, diagram and two installation views, Boston, Massachusetts, October 1968 (artwork and photographs © Pulsa)

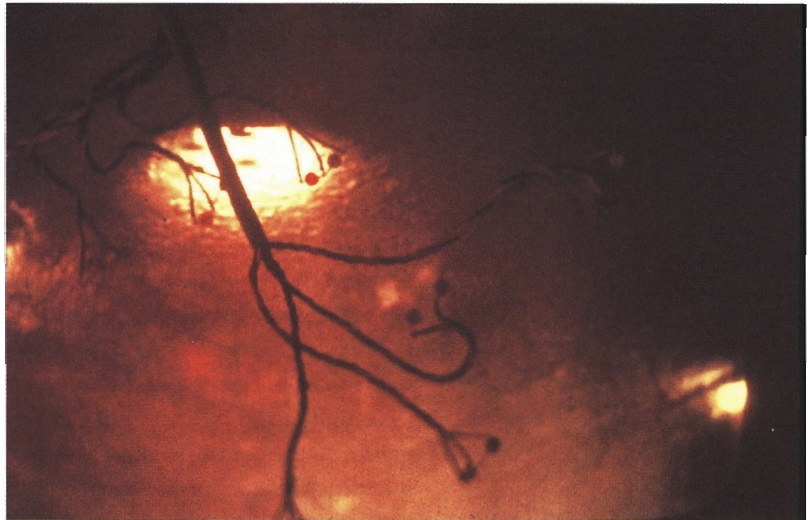
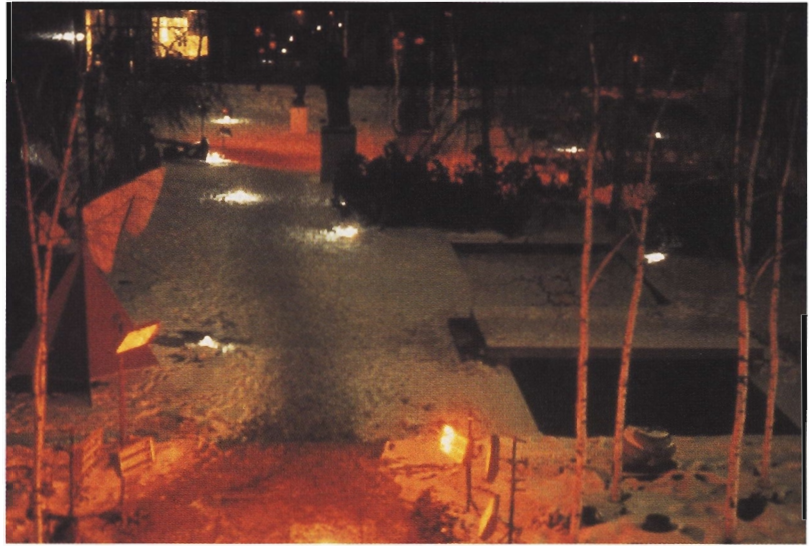
In October 1968 Pulsa performed a nocturnal technological alteration of the pond at the Boston Public Garden, an exemplary site of the “aesthetics of concealment” criticized in “The City as an Artwork.” Designed according to eighteenth-century conventions of the picturesque, the plan of the Public Garden was, in the eyes of Pulsa, guilty of attempting to suspend the urban systems surrounding it in favor of a spuriously “natural” landscape promising to provide relief to urban inhabitants from the problem-laden sociotechnical networks of the city. Pulsa transformed the “static” perceptual space of the garden into a dynamic sound-light “interface” by submerging fifty-five xenon strobe lights into its pond, along with distributing fifty-five corresponding polyplanar speakers around the pond’s perimeter. These two electronic systems—or “output devices”—were networked into a mutually responsive loop, with the artists providing a minimal set of programmatic instructions via an assemblage of “analog and digital computers, a punch-tape reader, a signal synthesizer, and magnetic tape” (209). The aim, according to Pulsa, was to prefigure a larger-scale experiment in linking the static “hardware” of the city and its dynamic “software” of information and energy flows. The aesthetic result of this perceptual experiment was a kind of a compositional, ambient, audiovisual event in which the landscape was reinscribed as an assemblage of abstract telecommunicative signals rather than a deceptively “natural” gestalt.

In 1969 Pulsa transplanted the principles of such computer-based “experiments in large-scale matrix distributions in open terrain” to another picturesque refuge within an urban landscape: the Yale Golf Course in New Haven. This project, encountered by Burnham and his pilot from the vantage-point of an airplane, provided an occasion for Pulsa to consider “ideas of . . . live-time feedback between the presence of people and the output of information” (210). A project at the Wadsworth Athenaeum later that year marked a further step in the direction of such random input. The project consisted of the minimal programming of the glass-enclosed Athenaeum with three “simultaneous systems” designed to condition and interact with aleatory environmental factors. First, Pulsa programmed the climate-control system of the building to vary with extraordinary intensity over a looped twenty-minute cycle between 55 and 80 degrees Fahrenheit, with varying degrees of humidity. Fourteen strobe lights were installed in the museum courtyard and a public street outside the gallery, projecting and refracting various patterns of light through the vitreous facade of the Athenaeum into the gallery space, and casting the shadows of external interruptions of the light beams. Perhaps most important, a system of multidirectional microphones was distributed both throughout the gallery and across the external facade of the building and redirected into the space of the audience. These microphones not only registered the “acoustic unconscious” of the internal and external environments in a Cagean fashion—the footsteps and voices of gallery-goers, for instance, along with the noise of traffic or weather on the street—but also interacted with a system of photocells that were themselves responsive to both the natural and artificial lighting systems impacting the environment.²⁷ Programmed according to a semirandom algorithm of response and feedback, these photocells “selected, mixed, and circulated various channels of input to six loudspeakers located at the corners and midpoints of the room” (212).

In 1970 the group was invited to retrofit the entire sculpture garden at

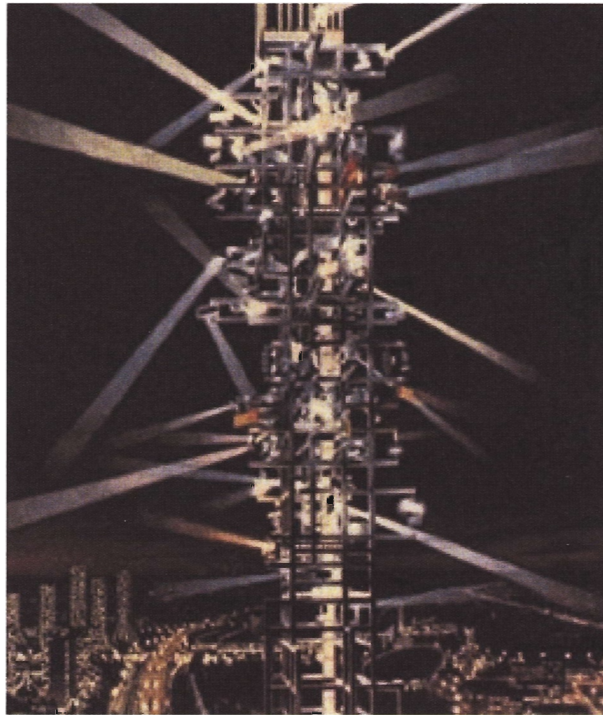
27. Adapting Walter Benjamin’s “optical unconscious,” Branden Joseph uses the phrase “acoustic unconscious” to discuss John Cage’s approach to an expanded field of sonic space in “The Tower and the Line: Toward a Genealogy of Minimalism,” *Grey Room* 27 (Spring 2007): 68.

Pulsa, untitled (installation, MoMA Sculpture Garden), 1970, closed-circuit television, infrared heat sensors, microphones, polyplanar speakers, analogue-digital signal synthesizer, installation view, sculpture garden, Museum of Modern Art, New York, January–February 1970, and screenshot (artwork and photographs © Pulsa; photographs provided by Michael Peter Cain)



MoMA with a layered network of environmental feedback systems semicoordinated through a “computer signal synthesizing system.” “Environmental information” was gathered by four kinds of input devices and fed back into the signal synthesizer—closed-circuit television surveillance, meteorological indicators, multidirectional microphones, and infrared heat-sensors. The data registered by these input systems was recursively rechanneled into the garden environment in real time via an assemblage of sixty strobe lights, twenty-eight infrared heaters, and eighty loudspeakers, “producing a synthesis among several systems and responsive to the presence and movement of an audience, as well as to weather conditions, the passage of airplanes and cars, and changing amplitude of sounds of the city” (214). More than in any previous work, Pulsa’s MoMA project aimed programmatically to incorporate both the urban soundscape and the bodily activity of the audience into its recursive temporality. This emphasis was also evident in Pulsa’s requirement that MoMA open the gates of the sculpture garden directly onto the

Nicolas Schöffer, sketch for *Cybernetic Light Tower*, 1969 (artwork © 2008 Artists Rights Society [ARS], New York/ADAGP, Paris)



street, enabling public access to the work free of charge for two nights a week over the course of the three-month exhibition. Pulsa thus aimed to enact a literal “expansion” of the sculptural field to encompass the energy flows of urban environmental systems, creating “supersensory areas that would make use of technology developed from research in biofeedback mechanisms” (210). Exceeding both the elementary relational dynamics of light, time, space, and body typically associated with works of Robert Morris, as well as the primitive media-delay feedback loops of Postminimal works such as Bruce Nauman’s *Corridor* (1970), for Pulsa, the presumed publicity of its “sculpture” consisted in marking the viewer’s body as a node in servomechanical networks of otherwise invisible energy and data flowing from the city in and out of the sensorium of a congenitally technologized subject.

Though she does not mention the relatively obscure work of Pulsa, Rosalind Krauss, in *Passages in Modern Sculpture*, laid out what she saw as the aesthetic and political stakes of (post) minimalism in part through a harsh repudiation of Burnham’s cybernetic program for its “mechanistic view of the world” and its goal of “controlling human destiny” through new technical systems of artificial intelligence. Drawing on Noam Chomsky’s critique of cold-war intellectuals’ collusion with “technocratic” functionalism, Krauss suggests that “these technocratic goals are not value-free, but are products of a social and economic system for which ‘control’ is the logical corollary.” In a polemical statement recalling the epoch-defining caesura declared by her colleague Annette Michelson between intermedia and structuralist cinema, Krauss goes on to suggest that the neutrality of cybernetic control systems “is precisely what much of contemporary sculpture (and art in general) wishes to overturn.”²⁸ Krauss traces the inhuman goal of “re-creating life” by technical means from eighteenth-century automata through

28. Krauss, *Passages in Modern Sculpture* (Cambridge, MA: MIT Press, 1977), 209–12. See Michelson’s denunciation of the complicity of intermedia discourse and corporate spectacle in “Film and the Radical Aspiration,” in *The New American Cinema*, ed. Gregory Battcock (New York: Dutton, 1967).

to Moholy-Nagy's 1930 *Light-Space Modulator*, associating that work's kinetic environmental interactions with an anthropomorphic illusionism in which the sculpture becomes a semi-intelligent robotic "actor." Against this simulation of organic life, Krauss posed the shock effect of Francis Picabia's *Relâche*, implicitly setting up the latter as a protominimalist exploration of the material conditions of bodily perception as opposed to the affirmative technophilia of Moholy-Nagy and his descendants.

The exemplary heir of Moholy-Nagy promoted by Burnham and criticized by Krauss was the French artist-engineer Nicolas Schöffer, who, beginning in the late 1950s, designed a never-realized "cybernetic tower" for the city of Paris in cooperation with the Philips electronics corporation. Extrapolating Moholy-Nagy's modernist celebration of "the cityscape at night as a pure pulsating light sculpture" into the postwar sociotechnical milieu, Schöffer's tower was designed to dynamically respond to and publicly broadcast on a monumental scale the shifting environmental conditions of the city—climate, light, traffic, economic productivity—thus feeding urban data back into the awareness and activities of its inhabitants as they traversed its systems with ever-greater functional efficiency. A consummate instance of "Cold War Constructivism," Schöffer's projected towers retooled Vladimir Tatlin's *Monument to the Third International* for the era of cybernetic planning in which the representatives of the people are replaced by automated, real-time monitoring systems designed to maintain the socioeconomic homeostasis of the capitalist city.²⁹

A comparable critique of Schöffer—and by extension the entire regime of cybernetically informed, post-Bauhaus design epitomized in the work of Kepes at MIT and his European counterparts—was also waged by Baudrillard:

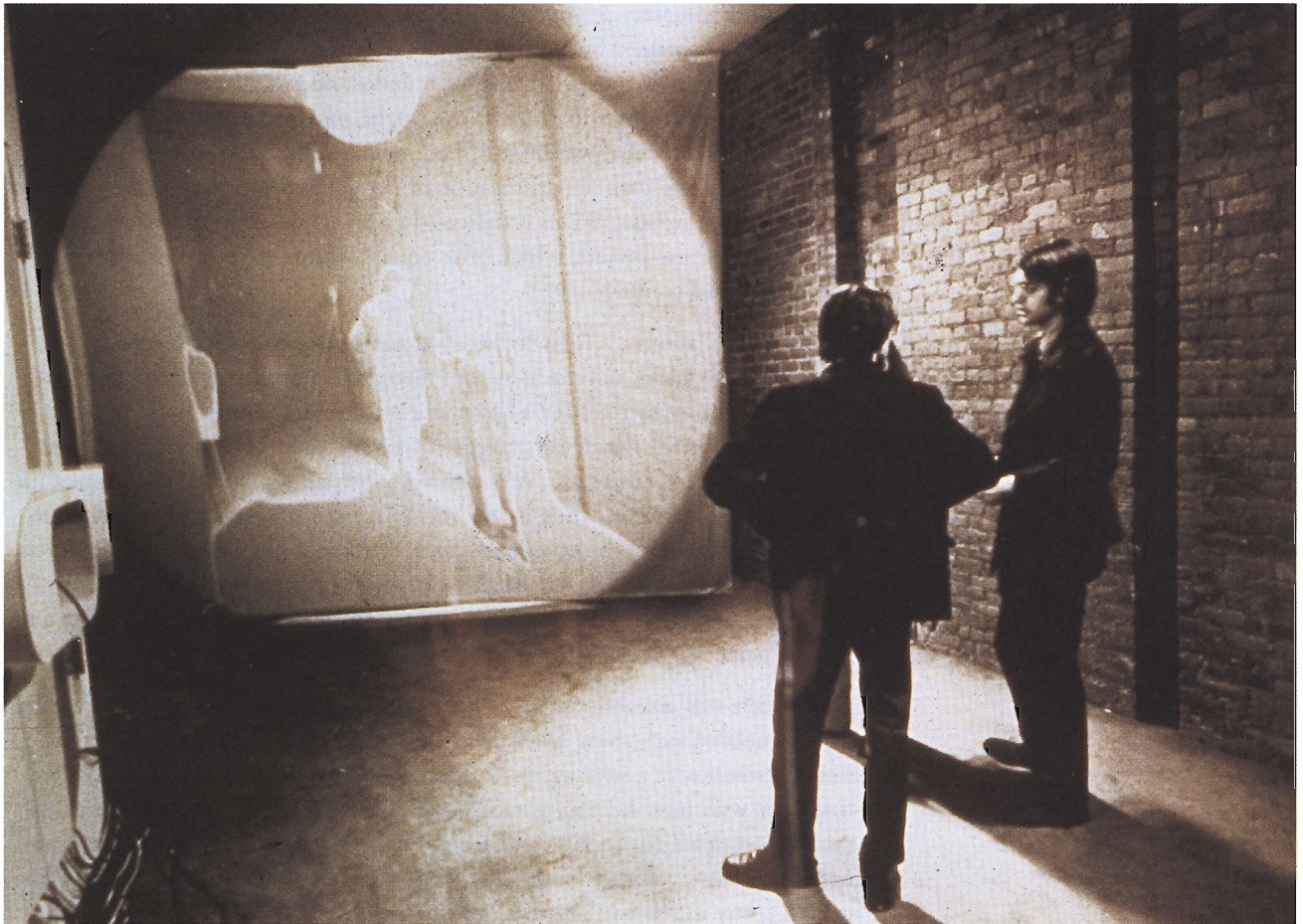
Where are we today? At cinematic manipulation, or "luminodynamics" or the psychedelic mise-en-scène of a debased surrealism; in short, we are dealing with a reassemblage that is in the very image of real systems, at an aesthetic operationalism (of which Nicolas Schöffer's *New Spirit in Art* is the biblical specimen) that is indistinguishable from cybernetic programs. The hyperrationality of these systems has absorbed the critical surreality of the phantasmic. Art has become, or is becoming, total design, METADESIGN.³⁰

For Baudrillard, the universally applied project of cybernetics represented a depoliticization of aesthetic practices and social relations alike, auguring a transition, as he further notes, from "a historically conflictive society to a cyberneticized society, to a synthetic social environment, where abstract total communications and an immanent manipulation machinery do not allow for anything to exist outside the system." Yet this sense of total immanence was an ideological claim of "the system" itself rather than an accomplished fact, and hence open to contestation: Baudrillard would invoke the aesthetic practices related to the recent events of May 1968, with the handmade street poster as an alternative that might disrupt the smooth functionality of "abstract total communications" embraced by a figure such as Schöffer.³¹ Baudrillard thus retained some trace of optimism about the possibilities of resistance, but the latter was still understood as resolutely opposed to "the system" as a monolithic entity rather than a horizontally distributed network of subsystems that themselves could involve moments of productive dysfunction, disturbance, or transformation.

29. Benjamin H. D. Buchloh, "Cold War Constructivism," in *Reconstructing Modernism*, ed. Serge Guilbaut (Cambridge, MA: MIT Press, 1986).

30. Baudrillard, "Design and Environment" 63–64. The ultimate symptom of this total immanence for Baudrillard was the extension of the informatic paradigm of "environment" to the realm of the biological.

31. Baudrillard, quoted in Scott, 110–12.



Pulsa, untitled (Automation House installation), 1971, closed-circuit real-time video system with video tape delays, rear-screen video projector, synthesized sound, programmed infrared, dichroic, fluorescent, and strobe lights, and potted-plant environment, installation view, Automation House, New York, 1971 (artwork and photograph © Pulsa; photograph provided by Michael Peter Cain)

Pulsa's work was certainly not antisystemic in the sense demanded by Baudrillard. Indeed, like many collectives in the 1960s engaged with technoutopian figures such as Fuller and McLuhan, an enthusiasm for ecological self-regulation often coincided with a fantasy of transcending the political. As Pulsa stated, "We are interested in taking a given public context (architectural, institutional, urban) and enhancing or expanding it. We are interested in transcending the functional political aspects of human experience and generating an abstract aesthetic awareness within an environment which exists primarily for non-aesthetic reasons" (221). The question for Pulsa remains whether it aimed to engage a different register of the political that would be irreducible to functionality, or whether the "abstract aesthetic awareness" it aimed to foster might even open onto a different politics of functionality altogether that would counteract the homeostatic drive of aesthetic operationalism denounced by Baudrillard.

It is thus worth considering Pulsa's pronounced desire to conjugate a model of ecological feedback among technologies, environments, and organisms with the contested principle of "participation" that has informed in different ways a wide range of art practices since the 1960s.³² The urban and architectural environments in which Pulsa enacted its large-scale interventions had permitted varying levels of participatory input, but in most cases this had been relatively unsuspecting and contingent, with the role of the audience reduced to that of

32. See *Participation*, ed. Claire Bishop (London and Cambridge, MA: Whitechapel and MIT Press, 2006).

frequently involuntary providers of ambient sound, movement, or heat to be detected and processed by semiprogrammed sensor technologies. Pulsa would become increasingly interested in what it understood as the open-ended creative potential of audience feedback in its own right, moving its work away from a model of what McLuhan would call “hot” media such as the radio to “cool” media, which “are high in participation or completion by the audience,” for example, the telephone.³³ This is indicated in Pulsa’s description of the 1971 Automation House project, which gives equal measure to programmatic control and spectatorial contingency:

The installations . . . included delayed and real-time events, feedback, and communication, and made use of video projections, amplified sound systems, a signal synthesizer, a switching matrix, and various lighting conditions. We made use of the presence of people as part of the artwork’s content as well as its process. We provided a flexible system and determined the spatial coordinates, while the visitors to the space were able to manipulate certain aspects of the equipment such as microphones, cameras, light levels, and musical instruments, thereby investigating unknown combinations of events and creating unique events within the system . . . moving within and participating in changing the nature of the artwork. (220)

Thus, while still insisting on a certain kind of aesthetic abstraction, by 1971 Pulsa had formulated something like a cybernetically informed anticipation of relational aesthetics. In a striking recollection of Nicolas Bourriaud’s model of “art that deals with inter-human relations,” Pulsa writes, “At its most basic level, the production of art can be interaction between people in the context of a heightened awareness, whether the product is an object, an activity, or a decision. Art is both a way to relate to life and a way to improve it; it is best experienced not only in the historical categories of the museum, but in the actual situation where people live (219).³⁴

Along with its various interventions in institutional and urban environments, Pulsa constructed its own research laboratory in the form of Harmony Ranch, an experiment in communal living, artistic collaboration, and participatory feedback situated on a farm outside New Haven. Given its pronounced investment in the aesthetic and social possibilities of electronic technologies, Pulsa’s appeal to an imaginary of self-organized, agrarian, communitarian existence was obviously not reducible to any simple pastoral nostalgia. Not unlike its contemporaries at Drop City in Colorado, Pulsa understood Harmony Ranch as a microtopian prefiguration of alternative social and ecological arrangements, the principles of which might be ultimately transplanted back into the crisis-laden city as a force of survival or revitalization.³⁵

For Pulsa, the urban crisis results from conventional approaches to the city as a set of “fixed and isolated structures . . . which offer little possibility for interaction among inhabitants” (213). Pulsa writes that the proper, dynamically interactive publicity of the city will be thwarted as long as “corporations and government engineers . . . control the reorganization of artifact systems. This would be better determined by the people of various neighborhoods who can decide for themselves how they relate to their systems” (213). As an alternative to the zoning and planning regimes that “fracture the city into specialized sectors

33. McLuhan, 36.

34. See Nicolas Bourriaud, “Relational Aesthetics” (1998), excerpted in *Participation*, 160–71; see also Claire Bishop’s ground-breaking critique “Antagonism and Relational Aesthetics,” *October* 110 (Fall 2004): 51–79.

35. On the “Droppers,” see Scott, 153–81.

Pulsa, untitled (agriculture, Harmony Ranch—herb garden), 1970, installation view, Oxford, Connecticut, 1970 (artwork and photograph © Pulsa; photograph provided by Michael Peter Cain)



systems and environmental networks with a Romantic ethos of community: “A community of artists is based more upon a willingness to share in the intelligent, life-supporting use of materials than on any common ideology. . . . Individual inclination and naturally evolved sense of respect for group survival would shape the future of the community. . . . The community’s art would consist in extending the sensory enhancement of all aspects of community life. From model projects like these, works could be designed to deal with larger systems” (220). Significantly, in light of this sense of community as a kind of group-organism striving for survival, a key component of Harmony Ranch was a system of “soil purification” and agricultural self-sufficiency: “We grow many kinds of vegetables organically on the farm. . . . Agriculture provides information about long-term growth rhythms and is comparable in scale and as an energy to Pulsa’s other projects” (216). Recalling its members’ interest in transforming the visual patterns of urban lighting systems, Pulsa redistributed wildflower seeds across the local landscape, “thereby altering the flowering population densities in nearby fields and along streams” in order to make visible the natural and artificial systems best equipped to sustain the germinal organisms in question. As in works by Pulsa’s interlocutor Hans Haacke, such as *Bowery Seeds* (1970), or Newton and Helen Harrison’s series of *Survival Pieces* (1971–72), the group’s engagement with systems ecology thus served to unsettle any absolute opposition between the organic and the technical, nature and culture, environment and media.³⁷ However, the name of the commune alone, inasmuch as it suggests a community grounded in a process of aesthetic and social cooperation assumed to be ultimately harmonious in nature, indicates that the unsettling of oppositions between natural and social systems does not in and of itself avert the pitfalls of what Miwon Kwon, following Jean-Luc Nancy, would call an “operative community”—an organic totality immanent to itself from which conflict has been expunged.³⁸

If Pulsa’s sense of community was informed in part by an ideal of harmonious cooperation, certain formal dimensions of its abstract aesthetic experi-

37. See Skrebowski, 74–76, for an account of the undecideability of natural and social systems in Haacke’s work. The Harrisons’ *Survival Pieces* transplanted cross-sections of endangered ecologies into the space of the art gallery, which was retrofitted into a life-support system at once physical and discursive.

38. See Miwon Kwon, *One Place After Another: Site-Specific Art and Locational Identity* (Cambridge, MA: MIT Press, 2002).

Pulsa, untitled (collaborative improvised sound sculptures), 1970, violins, sitars, ectaras, gongs, various metal objects, flutes, drums, analogue-digital signal synthesizer, amplifiers, and neural sensors, Oxford, Connecticut, April–May 1970 (artwork and photographs © Pulsa; photographs provided by Michael Peter Cain)



ments at Harmony Ranch arguably ran against the grain of this impulse, generating moments of what Burnham called “deviance-amplification.” For instance, among the most important activities undertaken at Harmony Ranch were “Collaborative Improvised Sound Sculptures” made with “violins, sitars, ectaras, gongs, various metal objects, flutes, drum, along with amplified natural and recorded sounds and electronically synthesized materials” and involving visiting collaborators such as the composers Nam June Paik, Karlheinz Stockhausen, Steve Reich, La Monte Young, and Richard Teitelbaum. These aleatory, horizontal experiments in the relationships among musical instrumentation, ambient sound, and technological distortion subscribe to what Branden W. Joseph has listed as the key principles of the post-Cagean avant-garde: “the end of the score as the source of compositional authority, the rise of collective improvisation, the



Pulsa, untitled (group music around mercury fog), 1971, mercury-vapor lamp, various musical instruments, analogue-digital signal synthesizer, installation view, Oxford, Connecticut, 1971 (artwork and photograph © Pulsa; photograph provided by Michael Peter Cain)

39. Branden W. Joseph, *Beyond the Dream Syndicate: Tony Conrad and the Arts after Cage* (New York: Zone, 2008), 106. Joseph's key contention is that post-Cagean projects "modeled, implicitly and explicitly, the multiple and mutually imbricated regimes of power within which and on which they operated" (107).

40. The decentralized organizational architecture of Mondrian was in fact a continuous reference for artists and theorists interested in cybernetic models in the postwar era, especially Kepes. See *The Language of Vision*, 47.

41. On the use of neurological energies in experimental electronic music and the proximity of these efforts to psycho-physiological research concerned with retraining the individual sensorium vis-à-vis new media technologies, see Joseph, *Beyond the Dream Syndicate*. Against the more-or-less functionalist goals of Manfred Eaton's project of "biomusic," Joseph describes Tony Conrad's inscription of film and musical audience into

direct impact of music as a powerful, affecting force, and the radical democracy of group-made decisions."³⁹

Pulsa illustrates this facet of its practice in *Arts of the Environment* with two images. The first is a close-up shot of four figures seated among a tangle of networked synthesizers and wind instruments, with an abstract painting on the wall that suggests the flexible circuit-board diagram as much as the all-over lattice-work of "digitized" pluses-and-minuses of Piet Mondrian circa 1915.⁴⁰ The second shows a single member of the group with electrode sensors affixed to his cranium, providing a primitive transmission of neurological energy pulses into a signal-synthesizer that displaced, delayed, and recoded them as a noncompositional, ambient noise marking the permeability of physiological and technological networks.⁴¹ Indeed, Pulsa insisted on a crucial dimension of spatiotemporal delay, recursion, and distortion that prevented any self-evident experience of the visual, sonic, or conceptual experience of "purified" energy. This was articulated most explicitly in the 1971 Automation House project, in which Pulsa deployed a closed-circuit video screen with increased beam control that deliberately aimed to produce what the group called "ghost-trails in delayed movement" of the viewers in a manner akin to contemporary "screen-reliant" experiments with real-time video feedback by artists such as Bruce Nauman, Dan Graham, Peter Campus, and Joan Jonas.⁴² Yet if such works by Pulsa conjure a form of phantom publicity in which the subject is simultaneously "activated" and "decentered" vis-à-vis emergent, real-time media systems, these terms were in continuous

biofeedback networks as a form of immanent biopolitical "counterprogramming" that "acted as both a harbinger and disruptor of this new 'infrastructure' of control" (351).

42. See, for example, Janet Kraynak, "Dependent Participation: Bruce Nauman's Environments," *Grey Room* 10 (Winter 2003): 22–45; Eric de Bruyn, "Topological Pathways of Post-Minimalism," *Grey Room* 25 (Fall 2006): 33–63; and Kate Mondloch, "Be Here (and There) Now: The Spatial Dynamics of Screen-Reliant Installation Art," *Art Journal* 66, no. 3 (Fall 2007): 21–33. See also Branden Joseph's discussion of the "spectral" dimension of certain works by Robert Whitman that ran against the grain of the otherwise "narcissistic" imaginary of expanded cinema, in "Plastic Empathy: The Ghost of Robert Whitman," *Grey Room* 25 (Fall 2006): 78–83.

43. Claire Bishop suggests "activation" and "decentering" as the two key imperatives of installation art, at least since Minimalism. As she points out, literal audience activation is often posited as an analogue to liberatory agency in the sociopolitical arena, while the decentering of the viewer through various forms of delay, interruption, or uncertainty is often read as a kind of exemplary ethical lesson about the viewer's relation to the alterity of others and the alterity within oneself. Bishop, *Installation Art* (New York: Routledge, 2005), 130–31. On the "acid dreams" of countercultural artists such as USCO, see Scott, 185–209.

44. Hans Haacke, "Letter, 1968," excerpted in *Art and Social Change: A Critical Reader*, ed. William Bradley and Charles Esche (London: Tate/Afterall, 2007), 174. It is important to note that as a group Pulsa identified as leftists, organizing a benefit for Bobby Seale at Yale, for instance. The gap between the publicly professed ideology of artists and the conceptual and formal parameters of their practices is not of course a problem unique to Pulsa during this period—consider the antiwar stance taken by a figure such as Carl Andre, for instance. As Skrebowski notes in "All Systems Go," Haacke was unique in his attempt to link his systems approach to specific issues of urban inequality. See Scott, 99–105, for a discussion of the Marxist critiques leveled against cybernetic models of urban organization by social-movement theorists such as Manuel Castells. On the "urban crisis" from the perspective of activist sociologists and planners, see Richard Cloward and Frances Fox Piven, *The Politics of Turmoil: Poverty, Race, and the Urban Crisis* (New York: Vintage, 1974). On the exclusions that generate images of the city as an actually or potentially harmonious totality, see Rosalyn Deutsche, *Evictions: Art and Spatial Politics* (Cambridge, MA: MIT Press, 1997).

45. See Pamela Lee, "Your Light and Space," in *Olafur Eliasson: Take Your Time*, ed. Madeleine Grynsztejn (New York: Thames and Hudson and San Francisco Museum of Modern Art, 2007).

46. Caroline A. Jones, "The Server/User Mode: The Art of Olafur Eliasson," *Artforum*, October 2007, 324.

competition with an almost mystical impulse of ambient communion akin to the mind-blowing "acid dreams" of the countercultural practices from which Pulsa had otherwise maintained a certain distance.⁴³ This impulse is illustrated by an image from Harmony Ranch, captioned "Group music around mercury vapor fog," that shows an expansive illumination against a nocturnal landscape, the source of which seems to have dissolved into so much atmospheric energy. Appearing at the edge of this radiant ambience is the silhouette of a group of diminutive human figures, themselves seemingly on the verge of being dematerialized into the sublime pulsations to which they simultaneously contribute and bear witness.

What are the stakes of considering the "public sensoriums" of Pulsa in relation to the field of contemporary art? As suggested earlier, recent discussions of relational aesthetics and collaborative production echo in important ways certain key problems explored—though by no means resolved—by Pulsa. The group's understanding of urban crisis as primarily a question of organizational design and ecological maladjustment, to be ameliorated in part by formal experiments in perception, failed to address the structured patterns of inequality of the city that had otherwise become inescapable for urbanism in the aftermath of the ghetto rebellions and claims to rights of the mid- and late 1960s. Indeed, the terms of race, class, and uneven development mark the constitutive exclusions of the "harmonious functioning of the city," which Pulsa imagined as being "prevented" by traditional forms of urbanism. An apropos remark in this regard was made in a letter to Burnham by fellow systems artist Haacke in the days following the assassination of Martin Luther King, Jr.: "No cop will be kept from shooting a black by all the light environments in the world."⁴⁴

One deeply resonant point of contemporary reference would be the technologically enhanced phenomenological experiments with light, time, and environmental systems of Olafur Eliasson. Drawing in equal measure on the Light and Space heritage of Robert Irwin and the universal design precepts of Fuller, Eliasson has pursued a similar negotiation of minimalist ambient sensitization, a technoscientific impulse of perceptual research, and a semi-utopian desire for an open-ended sense of community involving a thoroughly denaturalized model of ecological systems.⁴⁵ Of special pertinence to Pulsa is *Your Black Horizon*, Eliasson's site-specific project for the 2005 Venice Biennale, which consisted of the otherwise darkened gallery interior illuminated by LEDs (light-emitting diodes) whose constantly shifting color and intensity functioned as a digital index of the photon levels emitted by the city of Venice from dawn to dusk on a single day, data that had been compressed and transmitted into a repeating twelve-minute cycle. Eliasson optically engineered the light and space of the gallery so that upon exiting, viewers were left for several minutes with the after-image of a black horizon line inscribed in their visual field. In the enthusiastic account of Caroline A. Jones, "This folly's seemingly pure phenomenology is entrained in a larger discourse about energy consumption and urbanization. . . . [The work] may even begin worming its way into a darker space of anxiety about a global future without oil, an 'event horizon' of dark nights, a future catching up with us faster than we would like."⁴⁶ Though Eliasson and his critical advocates are likely unaware of the work of Pulsa, this conjunction of phenomenology, psycho-physiological processes, and environmental systems is an uncanny



National Aeronautics and Space Administration Goddard Space Flight Center, *Earth's City Lights*, 2000, composite satellite image, dimensions variable, produced by Craig Mayhew and Robert Simmon, NASA GSFC. Visible Earth, <http://visibleearth.nasa.gov/> (image in the public domain)

echo of the earlier group's concerns, especially as regards artificial lighting and the possibility of its interruption as a radical reorientation of temporal perception and ecological awareness alike. Eliasson shares Pulsa's relatively neutralized sense of urban publicity, problematically interpellating the audience with a "you" that, unlike the pronouns of Barbara Kruger, does not aim to position its addressee within a space of political and ideological conflict; instead it instigates a vaguely apocalyptic relation to environmental conditions that are presumed to be shared by what Jones calls "us"—the generic, phenomenological-cum-ecological subject—in an unmarked fashion. Or rather, the psycho-physiological apparatus of the viewer is indeed marked in the form of the horizontal afterimage, but like the "ghost-trails of delayed movement" in Pulsa's work, the afterimage is performed as a sheerly formal operation of perceptual decentering or estrangement that is assumed to activate some form of critical engagement with ecological urgencies.

With this limitation of Pulsa's practice in mind, an alternative strand of contemporary practice to which we might relate Pulsa would be urban-research groups such as Sarai, the Center for Urban Pedagogy, and the Spatial Information Design Lab, all of which have developed experimental aesthetic, spatial, and aimed technological interfaces designed to translate environmental data into visual information amenable to public comprehension, feedback, and use.⁴⁷ Like Pulsa, these groups eschew the revolutionary impulse of Baudrillard in favor of a long-term engagement with actually existing urban systems. But rather than propose an "abstract aesthetic awareness" for the viewer that would then be filled in with self-evident environmental data concerning resources, energy, and infrastructure, such groups approach data itself as a question of interpretive and aesthetic conflict. Partnering with students, environmental-justice organiza-

47. See the "Emerging Urbanism" and "Media City" interfaces online at www.sarai.net, the Center's website at www.anothercupdevelopment.org, and the Spatial Information Design Lab website at www.spatialinformationdesignlab.org.

tions, policy advocates, and technical experts, the groups offer their services as aesthetic engineers of the biopolitical claims made by urban inhabitants on the systems and agencies by which they are governed. Neither antigovernmental militants nor depoliticizing agents of aesthetic operationalism, such groups are concerned with what has been called, following Foucault, “nongovernmental politics.”⁴⁸ Without setting up such groups as the “activist” yardstick for the assessment of artworks in general, they provide an important check to the tendency of artists past and present to assume what Claire Bishop has called “a transitive relationship between ‘activated spectatorship’ and active engagement in the socio-political arena.”⁴⁹

A coda to Burnham’s aerial experience of Pula’s Yale project, with its “disturbing light phenomenon on the ground,” is the famous image known as “Earth’s City Lights,” a composite satellite photograph of the planet in its entirety at night produced by NASA in 2000. Recalling Moholy-Nagy’s invocation of “the poetry of a cityscape as seen from an airplane at night,” the image stages a dramatic play of luminosity and obscurity, tracing the uneven physical distribution of electrical power across the globe through the light given off by urban conglomerations. The image sends us a set of environmental signals to which we must respond, but, hovering between visibility and invisibility, the image does not provide any firm ground for its own deciphering. The meaning of these lights is not self-evident; insofar as they bear a constitutive relation to darkness and uncertainty, it is incumbent on us to read them in relation to other images, discourses, data sets, and histories in ways that exceed Burnham’s confident assertion that “by rendering the invisible visible through systems-consciousness, we are beginning to accept responsibility for the well-being and continued existence of life upon Earth.”⁵⁰ Indeed, any artist claiming to accept such a responsibility must attend to the “ghost trails” traversing our various forms of “abstract aesthetic awareness.” Without understanding real-time systems as haunted by those who are abandoned, marginalized, or obscured within the networks that support planetary life, a contemporary project of environmental art could unwittingly return us to the luminous communion of the global village, pulsating with a vital energy so intense as to vaporize the very life-forms its advocates would claim to protect and sustain.

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48. See *Nongovernmental Politics*, ed. Michel Feher, Gaelle Krikorian, and Yates McKee (New York: Zone, 2007); and my “Haunted Housing: Eco-Vanguardism, Eviction, and the Biopolitics of Sustainability in New Orleans,” *Grey Room* 30 (Winter 2008): 84–113.

49. Bishop, *Installation Art*, 11.

50. Burnham, *Beyond Modern Sculpture*, 292. On the non-self-evidence of photographic images and the necessity of reading them in relation to darkness, see Eduardo Cadava, “*Lapsus Imaginus*: The Image in Ruins,” *October* 96 (Spring 2001): 35–60.